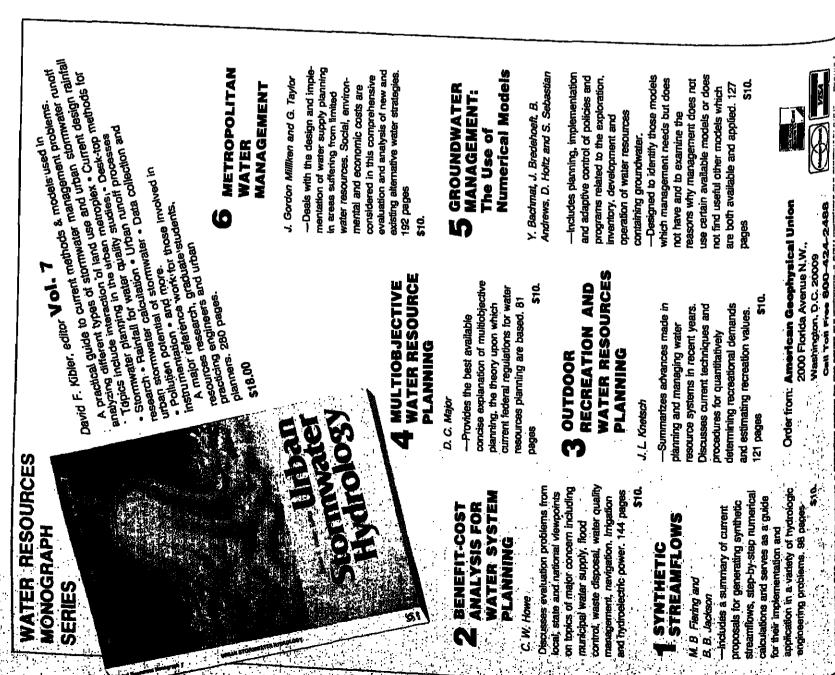


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News

Mount Erebus Activity

An international team of scientists reports that unusually high seismic activity joggled Mount feebus last fall. However, the Antarctic volcano showed no external signs of an external signs.

when scientists from the United States, Japan, and New Zealand returned to the world's southernmost active volcano last November for their annual field expedition. they found that seismic stations recorded 650 small tremors on October 8; prior to that, the number of quakes had averaged between 20 and 80 per day. The October 8 maximum was followed by 140 on October 9 and 120 on October 10. Philip R. Kyle, assistant professor of geochemistry at the New Mexico Institute of Mining and Technology in Socorro and leader of the team studying Mount Erebus. noted that some of the strongest earthquakes recorded during the team's 3 years of observations occurred on October 8; these registered less than 2 on the Richter scale.

The quakes at the 3800-m volcano were caused by magina moving within the earth, similar to the mechanisms recently jarring the Mammoth Lakes area in California (Eo., August 3, 1982, p. 593, and June 29, 1982, p. 553), according to Kyle, who recently filed the team's report with the National Science Foundation (NSF). (NSF funds and coordinates all U.S. activities in Antarctica.) Kyle stressed that there is little, if any, chance that the volcano would erupt. Unlike Mount St. Helens, there is no pressure being built up in Erebus, which is in a state of hydrostatic equi-

Erebus' crater is a lava lake of molten rock 90 m in diameter. One of the world's two active lava lakes, the lake is believed to be the top of the volcano's magma chamber, a storage area for hot molten tock within the mountain, according to NSF. During the fall expedition, the scientific team noticed that in 1 year the lake level had fallen by 3 m and had lost 8500 m³ of lava. The team speculates that the magna forced itself into a crack in the volcano and spread out to form a dike. The possible location of the dike is unknown, however. A more detailed report will appear in an upcoming issue of the SEAN Bulletin.

Meteorite Samples

The more than 5,000 meteorite samples retovered from the Amarctic ice sheet since 1969 are available for study, it was recently announced. The samples, which include rare types and fragments suspected to originate from sources other than the asteroid belt, were collected with support from the National Science Foundation (NSF) and are curated in a joint program of NSF, the National Aeronautics and Space Administration, and the Smithsonian Institution.

Send your request for samples to the Secretary, Meteorite Working Group, Curator's Branch, SN2, NASA, Johnson Space Center, Houston, TX 77058. A newsletter, workshop report, and additional information may be obtained without charge from the Lunar and planetary Institute at the same address. Catalogs on the meteorites are available, also at no charge, from the Department of Mineral Sciences, National Museum of Natural History, Mail Stop 119, Smithsonian Institution, Washington, DC 20560.

Seabed Mining Law in Turmoil

When it was realized last December that the United States would not sign the United was suspected that the issue of deep seabed mining was a precuninent factor. According to a recent discussion by members of the Marine Resources Project of the University of Manchester, U. K. (New Sci., January 1988), the thinking of many national delegations was focused on the aspects of ocean-floor nodule mining. The United States would rather make less sweeping agreements, limited to those countries that already have deep-sea nining investments. Such an agreement has seen made on an interim basis between the United States, France, West Germany, and the United Kingdom. Third World nations, on the other hand, have a vested interest in aving the convention signed, because they would share in the profits

would share in the profits.

There are 2 years left during which nations may sign the convention, but how the rules of deep seabed mining will be decided could be influenced before then. The worry is that rival groups of the signers and the nonsigners could endanger the nodule mining industry

as well as the oceans.

The third U.N. Conference on the Law of the Sea (UNCLOS) ended what had been almost 10 years of deliberations by the 119 national delegations. The main objective of the conference was to offset the development of

the oceans and to protect them. There had been, as a part of the overall effort, a strong movement to transfer some of the wealth gained from the mining of nodules to Third World nations. The convention set up the International Seabed Authority (ISA) which is to take steps to compete with mining compa-nies. According to the University of Manchester report, Private companies would, among other things, have to agree to provide the Enterprise (the operating arm of ISA) with fully prospected sites and sell it technology if they want to obtain mining licenses from ISA. . . . There is no doubt that the convention offers far from ideal terms for private companies contemplating nodule-mining. The United States did not find this part of the convention workable. The bureaucracy of the system would be unmanageable, and such a convention could have far reaching implications in the future for the international regulation of

other resources.

The status quo is one of confusion. Nations appear to have lost sight of the main provisions of the UNCLOs convention. Third World nations are looking forward to sharing a piece of the wealth and the high technology. The western-nation delegations, particularly the United States and Great Britain, are not signing the convention yet or at all, and the United States is lobbying to support others not to sign. The nature of the convention is that amendments that may appeal to western delegations cannot be made now.

The Marine Resources Project at Manchester notes that if Britain or other deep-sea mining countries are to affect the outcome, they must sign the convention. The next step in the process is to set the rules that will implement the provisions of the convention. Implementation is to begin in Jamaica this March by PREPCOM, the Preparatory Commission for the ISA and by the International Tribunal for the Law of the Sea. It is thought that a number of the important decisions

could be made by PREPCOM when it meets. The potential economic consequences of the circumstances are severe. If an unstable, fragmented regulatory system results from the present deliberations, deep seabed mining companies may end up with huge legal disputes in the International Court of Justice. The governing body could possibly rule out all seafloor mining activity for an indefinite period. The ISA itself needs contributed funds from the wealthy nations to be able to operate; but even without the necessary funding, it would appear possible to delay or prohibit mining operations.—PMB

New Hydrology Program Set

A hydrology-rogram leading to a bachelor of science in hydrology will begin this fall at Tarleton State University, a part of the Texas A&M University system. The 4-year program aims to prepare students for entry-level positions leading to professional, hydrology-related careers and for appropriate graduate academic programs.

demic programs.

Included in the program's core curriculum are courses in calculus, statistics, chemistry, biology, physics, geology, soil science, computer science, and water-related courses in mechanics, hydraulics, hydrology, groundwater, water treatment, water quality, and water resource management. The program will be guided by a director in conjunction with an external advisory board of professionals knowledgeable about and concerned with the responsible use and management of water re-

For additional information, contact T. C. Hinkson, Head, Department of Physical Sciences, Tarleton State University, Box T-69, Tarleton Station, Stephenville, TX 76402.

Field Research Support

The Center for Field Research is seeking research projects eligible for support by Earthwatch. Earthwatch is a private, volunteer research corps that enables qualified members of the public to join research expeditions both as coworkers and as patrons helping to underwrite expedition costs. To qualify for selection by the center, projects must be designed to make effective use of nonspecialists in field assignments.

Each year, the center selects for support by

Each year, the center selects for support by Earthwatch up to 100 significant projects each year in the sciences and humanities. Current priorities for support include volcanology, climatology, glaciology, oceanography, and research in Latin America (especially that which illuminates interdependencies between North and South America).

The next deadline for proposals is April 15, 1983. For application guidelines and a list of currently supported projects, contact Sara Bennett, Assistant Director, The Center for Field Research, 10 Juniper Road, Box 127, Belmont, MA 02178 (telephone: 617-489-

Among the projects that have been approved for support for 1983-1984 are a geological study of barrier island migration and crosion; a study of climatic prehistory of Tahiti and Easter Island; an investigation of nearshore circulation around Bermuda; research on plant recovery at Mount St. Helens; an investigation of the implications for the origin of megacrysts and the behavior of basalt magma deep within the earth; and an examination of variable stars as an opportuni-

New Geothermal Gradient Data Map

ty to test theories of stellar structure and evo-

A new, multicolor, geothermal gradient map of the continental United States has been produced as a joint publication of the National Geophysical Data Center (NGDC) and the Los Alamos National Laboratory (LANL). The map, which replaces the 1980 version published by LANL, presents a compilation of more than 1,700 wells that have been measured for temperature at depths greater than 50 m. Temperature/depth profiles are linear or are composed of linear seg-ments reflecting changes in the thermal conductivity of the rocks. The data are displayed on two sheets, one for the east and one for the west, at a scale of 1:2,500,000. The location, depth, and gradient of each well is noted with a single, color-coded symbol. Each well also is numbered and keyed to a table showing latitude, longitude, well depth, gradient, heat flow (where available), thermal conductivity (where available), and a refer-

Cost of each map set is \$10 folded or \$12 flat. Digital data used to make the map and listed in the table on the map also are available. Output may be obtained on magnetic tape for \$200. For additional information, contact the National Geophysical Data Center, NOAA, Code F/GC1, 325 Broadway, Boulder, CO 80303 (telephone: 303-497-6125).

Geophysicists

Helmut E. Landsberg, past president of AGU, received the William F. Petersen Foundation Award in recognition of his many scientific contributions to Human Biometeorology. The gold medal award is made every 3 years to a leading scientist in the field of plant, animal, and human biometeorology. Landsberg is the sixth recipient of the award.

Eric G. Lappala has joined Harding Lawson Associates, consulting geotechnical engineers, as an associate hydrologist. A 18-year veteran of the U.S. Geological Survey, he most recently directed technical investigations for projects involving groundwater contamination in complex aquifer systems in Culorado, Utah, and California.

Kurt W. Riegel has been appointed the head of the astronomy centers section in the National Science Foundation's Division of Astronomical Sciences. Previously, he was associate director of the Office of Environmental Engineering and Technology at the Environmental Protection Agency.

Pater Wilkniss, former senior science associate in the office of the NSF director, is the new deputy assistant director of the NSF Directorate for Scientific, Technological, and International Affairs (STIA).

In Memoriam

Mark B. Burgunker, an AGU member since 1951, died March 24, 1982. He was in his late sixties.

New GRL Editors

President Van Allen has appointed an editor-in-chief and five new editors for Geophysical Research Letters. To speed the review process, editors from North America, Europe, Asia, and Australia were selected. Manuscripts should be submitted directly to one of the following editors:

James C. G. Walker (Editor-in-Chief), Geophysical Research Letters, 2455 Hayward, Ann Arbor, MI 48109, USA.

Renneth J. Hst., Geological Institute E.T.H., Sonneggstrasse 5, Zurich, Switzerland 8006.

Gaston Kockarts, Institut d'Aéronomie Spatiale, 3 Avenue Circulaire, 1180 Bruxelles, Belgium.

Kurt Lambech, Research School of Earth Sciences, Australian National University, POB 4, Canberra, ACT, Australia 2600. Tetsuya Sato, Institute for Fusion The-

ory, Hiroshima University, Hiroshima, 730, Japan. Rob Van der Voo, Geophysical Research Letters, 2455 Hayward, Ann Arbor, MI

48109, USA.

Books

Earthquake Prediction Techniques: Their Application in Japan

T. Asada (Ed.), University of Tokyo Press, xii + 317 pp., 1982, \$34.50.

Reviewed by Carl Kisslinger

Japan is serious about solving the earthquake prediction problem. A well-organized and well-funded program of research has been under way for almost 20 years in pursuit of the national goal of protecting the dense population of this earthquake-prone

dense population of this earthquake-prone country through reliable predictions.

This rather amazing book, edited by Toshi Asada, retired director of the Geophysical Institute of the University of Tokyo, has been written by 10 scientists, each of whom has made important contributions to earthquake science, but who have not been known in the past as principal spokesinen for the Japanese earthquake prediction program. The result is a combination of a very readable tutorial presentation of basic earthquake science that will make the book understandable to the nonspecialist, a good summary of Japanese data and research conclusions, and a bare-knuckles appraisal of current philosophy and strategy for prediction in Japan.

The book is logically organized so that 12 independent chapters by 10 authors result in a coherent treatment of the subject. Disagreements between authors show up; it would be strange if they did not exist in the present state of knowledge of prediction. It is refreshingly clear that no attempt was made to smooth away the rough spots.

The tone is set in Asada's preface: 'Although there are several good books on earthquake prediction, they all have one drawback. Due to the way the material is pre sented, the reader can easily come away thinking that earthquake prediction is a fair accompli, that there are only a few problems that remain unsolved. Concern about an accurate appraisal of what is now possible and what is likely to be possible within the next few years with regard to reliable predictions is especially great in a country that has on its books a remarkable piece of legislation, the Large-Scale Earthquake Countermeasures Act of 1978. This act assumes that earthquakes are predictable and that predictions of lamaging earthquakes, with concornitant social impact, may be issued in the near future.

The book is organized in four parts:
'Earthquakes Repeat Themselves,' 'Long-Range Precursors,' 'Short-Term Precursory Phenomena,' and 'The Road to Actual Earthquake Prediction.' The first part starts with a brief history by Asada of the development of seismology in Japan. Usami provides a manual of good practice in using historical documents for learning about pre-instrumental earthquakes as he summarizes knowledge of ancient Japanese earthquakes. He emphasizes the patterns of repetition of great earthquakes within the distinct seismogenic zones of Japan and the implications for identifying the sites of future ones.

Matsuda's chapter, 'Earthquake Scars,' brings the methods of geological field studies to bear on the derivation of the history of movement on Japanese faults. Presenting empirical relations between maximum fault slip and magnitude and fault length and magnitude, he proceeds to the prediction of earthquake recurrence intervals from geological data. He confronts the problem of agreeing on a definition of an 'active' fault, and he presents the classification of active faults in Japan into three groups, depending on the mean annual rate of slip. Tables with data about many of the best known Japanese faults and of the major earthquakes associated with these are included.

I was perplexed to find in this chapter the first of several references in the book to 'the' Matsushiro earthquake, given once as in 1966, again as '1965-'. The event involved is, of course, the great earthquake swarm of 1965-67, during which over 700,000 earthquakes occurred. The discussion will be baffling to the reader who is not familiar with all of this. The statement on p. 33 that, 'The Matsushiro earthquake is the smallest ... to have left behind visible earthquake faults on the land surface of Japan' is misleading in that, though the largest event in the swarm had a magnitude less than 5.5, the magnitude equivalent of the total energy release was close to 6.5.

Long-range precursors are sought as a means of identifying places at which the earthquake hazard, as revealed by the historical and geological studies, appears to be substantially enhanced at the moment, and where intensified observations capable of revealing short-term precursory, behavior are justified. Temporal and spatial patterns of seismidity can provide guidance to such places. Takagi's chapter on the occurrence of small carthquakes describes this approach and convincingly demonstrates the valuable information provided by the monitoring of microcarthquakes with dense regional networks.

Unfortunately, the dual use of the term 'scismic gap,' entrenched in Japan, is perpetunted here. Some of the statements including this term are ambiguous if not misleading Mogi clearly defined gaps of the first and second kind, to distinguish between a portion of a seismic zone within which no great earthquake has happened in a long time and a portion of a seismic zone within which the rate of occurrence of moderate to small earthquakes is abnormally low. The qualifying phrase is often dropped in Japanese texts. It is preferable to substitute a term like 'zone of quiescence' for 'gap of the second kind'. Onset of quiescence may be a precursor; the existence of a gap (of the first kind) is not.

Yoshii's discussion of precursory variations in seismic velocity is not a research paper but a thoughtful discourse on the sources of error in every method available for measuring velocity and the difficulties in detecting rea changes. He reviews briefly and criticizes all methods except the use of mechanical vibrators of the kind used in reflection seismic exploration. Some fundamental concepts, such as the value of multidirectional velocity measurements to detect anisotropy associated with dilatancy and possible effects of attenuation-induced dispersion on very high precision body-wave velocity measurements, are

Detection of crustal deformation (as evidence of accumulating strain) by repeated geodetic surveys and other techniques has been a corneratone of the Japanese prediction strategy from the beginning. Sato reviews this subject in terms of long-term prediction. After summarizing a number of case histories, he says on p. 125 that. In my experience there are far more cases in which no link is found between ground uplift and earthquakes than there are cases in which there is a link.' Even this highly regarded approach fails to produce the ideal precursor that has been sought in vain.

As in all of the data-oriented papers in this olume, Sato reviews the sources of error in this technique. He does not mention the debate over the reality of the Paladale uplift in this country in his discussion of leveling errors. This may be because, though the book carries a 1982 publication date, the original Japanese version appears to have been written about 1978, with only minor updating for the translation.

Continuous observations of crustal movement (Suyebiro) follows logically as the first chapter in the section on short-term precursors. Although observations with extensometers and tilt meters are included, most of the chapter is devoted to the borehole volumetric strain meter. Anyone who has seen the banks of recorders in the prediction center at the Japan Meteorological Agency, linked by telemetry to a great network of these devices. will not be surprised by the amount of attention given to these observations. Clearly, Japanese specialists expect to see a pattern of short-term changes in strain as one indicator of an imminent earthquake. This ingenious instrument has been largely ignored in this country even though it was developed here.

Changes in level and chemical composition of groundwater (Wakita) and precursory electromagnetic phenomena (Mizutani), including resistivity changes in the ground and geomagnetic variations, are covered in the last two chapters on precursors. Wakita offers a comprehensive summary of Japanese work on hydrological precursors and a table of 113 case histories. His background discussion of precursory radon concentration changes will be helpful for those not familiar with the ideas. He gives a realistic appraisal of the fu-ture of geochemical prediction methods.

Mizutani reviews reported precursors in the general category of electromagnetic phenomena. He concludes that reported values of precursory geomagnetic variations have become smaller since the introduction of proton-precession magnetometers, because of the greater stability of these instruments. Another interpretation of the data he offers, backed up by other field and laboratory studies, is that the total magnetic field measured by the proton-precession instrument may very well se the wrong thing to observe for this purpose. If the primary effect of high strain in ks is to rotate the magnetization vector with little change in total intensity, one ought to measure orthogonal components of the field, or declination and inclination. Mizmani's own very interesting work on the electrokinetic effects of water flowing in cracked rocks is briefly reviewed.

The final section of the book addresses the application of all of this science to the real ediction of destructive earthquakes. Ishibashi is harshly critical of the present Japanese strategy, mostly because he has no faith in the evidence for magnitude-dependent precursor times, and offers his own approach. Space does not permit a thorough review of this iconoclastic blast, but it makes good reading. Takagi offers his own flow chart for reaching a prediction decision based on the evaluation of short-term phenomena. Usami concludes the book with a history of Japanese prediction research from The Blueprint of 1962 to the time of writing. Many interesting facts are given, including the algorithm action of droubles the world because in the second transfer of droubles the world because in the second transfer of the tacts are given, including the argument action of dropping the word research from the title 'Earthquake Prediction Research Project' after the first five years. We in the United States have held on to that word firmly, emphasizing that the work we are doing is research to learn how to predict earthquakes,

not the prediction of earthquakes. The book is very nicely produced, with good paper, figures, tables, etc. There is a small problem with the translation. Although the translator is obviously a professional with an excellent command of English, and the language is not only fluent but poetic in places, there are numerous examples of nonstandard usage and coinages. 'A telemeter' is a generic term for any sensor, the output of which is telemetered. 'Lateralation' means the distance between points in a geodetic survey. 'Deterioration' of the crust may mean the formation of microcracks at high stress levels. Most of these expressions do not in any way interfere with understanding, and the use of colloquiallisms, such as 'budget-buster' (the ediction budget?), enlivens the text.

There are a number of technical points that I would fuss about with the authors, Given the state of our understanding of earthquake physics and prediction, every know-ledgeable reader will probably have his own set of these. Some omissions, such as in situ stress measurements and space-geodetic techniques for monitoring localized crustal defor-niation, are regretable, but the book is intended to reflect what is going on in Japan. not world-wide.

Those who have engaged in the lengthy and heated debates in our own country about the best directions for our prediction efforts will find this book fun to read as it pierces the serene outer surface of the Japanese scientific community. More important, there are lessons to be learned from those in the forefront of the world effort in prediction for all who are responsible for planning earthquake research and, eventually, for planning the implementation of a real prediction system.

Carl Kisslinger is with CIRES, University of Colorado, Boulder.

Laser Beams in the Atmosphere

V. E. Zuev, Transl, by J. S. Wood, Consultants Bureau, New York, xi + 504 pp., 1982.

Reviewed by Kenneth Sassen

There is a growing, interdisciplinary field of research which I prefer to call lidar meterrology. It involves the probing of the atmosphere with laser beams to measure the various physical parameters of concern to atmospheric scientists. When this is done with a high-energy, pulsed laser, that is, with a lidar system, the atmosphere can be monitored at unmatched spatial resolution and at reasonably long distances. Gradually, lidar researchers are venturing from their technologically oriented conferences into the realm of the applied atmospheric sciences—they have lately been seen at conferences devoted to air tion, atmospheric radiation, cloud physcs, and even radar meteorology.

A suitably generalized manual on the various lidar remote sensing techniques and their applications has been long needed to legitimize this field. Such an enterprise should, in my opinion, gather together the requisite knowledge on the propagation of monochiomatic radiation through the atmosphere in its many states, summarize the state-of-the-art technologies of lasers and laser signal processing, and then combine this knowledge to show what has been done and can be done with laser beams in the atmosphere. Laser Beams in the Atmosphere by V. E. Zuev, Director of the Institute of Atmospheric Optics of the Siberian Branch of the Academy of Sci-

ence of the USSR, comes close to filling this The original monograph, apparently published in 1977, has recently been translated by James S. Wood into an easily readable book. Although much of the information contained in the book would be of interest to workers outside the discipline of lidar meteorology, including those involved in laser communications and geodesics and atmo radiative transfer in general, it is clear that the material covered in the seven chapters represents the insight of a researcher who has participated in the development of the atmospheric laser probing field. There is presented throughout a good balance of material derived both from theoretical and experimental sources. The numerous references come mainly from the Soviet Union, but key studies from abroad are generally included as well. The reader is thus provided with a rare glimpse into the breadth of work being per-formed within the Soviet Union, even though

a large body of the references will remain obscure to us because they are either untranslated or otherwise difficult to obtain. The contents of the book can be divided into three areas. The first five chapters competently summarize the factors governing the propagation of laser energy through the atmosphere without stressing a great amount of theoretical development. Chapter I, Refrac-tion of Light Rays in the Atmosphere, briefly considers an area commonly overlooked in li-dar observations but which can be of considerable concern to astronomical and geodesic measurements. In chapter 2, Absorption of Laser Radiation by Atmospheric Gases, theth-

ods for overcoming the special problems association stranger still to make this section principal ciated with the quantitative determination of the absorption of highly monochromatic tach ation are explored. First, though, the chapter begins with summaries of the basic equations and factors affecting the spectral line shapes after which the origins of the absorption spectra from the pertinent gaseous constituents at the laser frequencies are discussed in a quite understandable manner Chapica 3 The Scattering of Laser Radiation in the Armosphere, is an even more comprehensive summary of fundamental scattering theory and experiments. Although the effects of particle non-sphericity are largely overlooked in favor of the more treatable case for splicies. specific attention is given to the playsmal and scattering characteristics of the clear, hazy, cloudy, and precipitating atmospheres. Chapter 4, the Propagation of Laser Radiation in a urbulent Atmosphere, and chapter 5, the Nonlinear Effects Associated with the Propagation of Laser Radiation in the Atmosphere complete the discussion of the interaction of the atmosphere and laser beams. Strong theoretical support is presented for these difficult subjects, and there is discussion of significant experimental results which are new to me. such as those in a number of Russian studies assessing the effects of CO2 laser beam propagation through clouds.

The next major area covered in the book is found in chapter 6, Optical Background Noise in the Atmosphere. It is an appropriate topic to include in a lidar mereorology text, but despite the amount of important information given on the passive optical signal the usefulness of this chapter is limited by the lack of consideration of the additional factors which go into determining the signal-to-noise ratio. Nowhere in this chapter, or in the book for that matter, is discussed the manner in which the scattered laser signals are detected and processed. This points out a general difficulty I have with the book: Little is said about the operating and signal processing characteristics of modern laser systems. It is through an examination of data tables, for example, that the wavelengths of the available

laser sources can be most readily determined. The final and most lengthy chapter. Laser Applications in Atmospheric Research, is an excellent summary of the types of information which can be remotely sensed with lasers. The techniques described include the probing of aerosols and clouds with clastic scattering and depolarization measurements and the monitoring of the atmospheric parameters of state using Raman and laser-spectroscopic approaches, but this is by no means a complete list. The consideration given to the basic apoaches to laser signal analysis is quite help ful, and each section is generally introduced by a theoretical discussion of this sort. Numerous experimental results are cited, but unfortunately the list of references is hardly up to date owing to the apparent delay in the translation process. Since especially capid progress has been made over the past several years in the area of laser field applications, it s in this section that the publication delay is ne most regrettable.

In summary, I find Laser Beams in the Atmasphere to be a valuable reference book for researchers in the atmospheric remote sensing field. Despite the shortcomings mentioned above there is no other book yet available which compiles such a wealth of information of fundamental concern to the lidar meteo-

Kenneth Sassen is with the Department of Meteorology, University of Utah, Salt Lake City.

Geodynamics: Applications of Continuum Physics to Geological Problems

D. L. Turcoue and G. Schubert, John Wiley, New York, ix + 450 pp., \$29.95.

Reviewed by Philip Englar

The authors' intention in this book is to provide a treatment of the physical processes that are responsible for plate tectonics and other geological phenomena in a manner that is accessible to senior undergraduate and graduate students of diverse backgrounds in the physical and earth sciences. To this end, they have divided the subject into eight sections, preceded by a brief introduction to plate tectonics. This is perhaps the least felicitous chapter of the book: Summarizing plate lectonics, its driving mechanism and our knowledge of the inner planets, their satellites, and the Galilean satellites in about 30 pages of text is not a trivial undertaking, and while I have read several far worse attempts, I doubt that this chapter will give a clear idea. of geodynamics to, say, the average engineering student. Part of the problem lies in the breathless rush through an immense amount of material, some of which is still in a state of flux, and part lies in the curious organization of the material. It seems strange, for example, to put a section on the structure of the ontinents after sections on accreting plate margins, subduction, and transform faults and before a discussion of paleomagnetism, plate motion, and triple junctions, and

an introduction to geochionology.

The remaining enditchapters considered stress and strain, the clasticity and flexing () hear remister to gravity, the fluid mechanic (2) took throdogy (8) faulting and (9) flowing persons media. The structure of most dap ters corresponds to an abhreviated dasiol sounds form his the base principles of the chapter threat classicity, Confer's law of Hear Conduction, (b) are introduced, the there is usually a discussion of the meanty which the bettiment operivations are made these ideas are their developed through a k ries of applications that lead up to the migr topic of the chapter to g. Hexate of the ocand behosphere in chapter 3: lithosphere! mande thermal structure in chapter 4: dising mechanisms in chapter 6, mantle conction and thermal lustory of the earth in the (ct. 7), sometimes the chapter is terminated with a funct coda on a less general aspecto

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Chinese Geophysics

Volume 2, Numbers 1 and 2 Volume 2, 1982, 83 Earthquako Rosearch in China 3 Earthquako Resourch in China: 4 Francis T. Wu, editor

Translated articles

and solociad abstructs from Acta Goophysica Sinica and Acta Salsmologica Sinica plus contributed papers and a table of Romanization (Pin-Yin and Wade-Gilos) of Chinoso namos. both short and long term carthquake prediction in China. placement, crustal and upper-mentle research, abnormal animal behavior as 122 short-term earthquake precursers, and more.

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the subject which has caught the authors' at-

There is much to be commended in this approach; it leads to familiarity with some analytical tools that are used to approach the dynamics of the earth; the copious use of problems complementary to the text and the clear and detailed exposition of the mathematics (on occasions perhaps too detailed) mean that anyone with second-year undergraduate mathematics should be able to follow the book from beginning to end.

There are, however, distinct drawbacks as well, mainly to do with the balance of text: the average earth science student would, I suspect, prefer rather more discussion of the physical principles and rather less mathemates than are found in most of these chapters. Although the progression of applications within each chapter is carefully chosen to lead the student through the concepts necessary to understand the major processes in odynamics as we know them, there is too little time spent on these processes themselves. For example, the chapter on fluid me-

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Cover. A large fumarole field discovered n 1980 E-SE of Makushin Volcano on Unalaska Island, Alaska. Makushin Volcano, shrouded by clouds, can barely be seen at top right of the photo. Five fumarole fields, all roughly aligned along a suspected N50°E rift zone as marked by several large centers of recent basaltic extrusion, were examined. The field shown is about I km long and up to 0.4 km wide. This photo was made on August 9, 1980 gay of the fumarole-field discovery). during geological field-mapping investiga-tions of Unalaska Island; such studies are being conducted as part of the Geothermal Program in the Division of Geological and Geophysical Surveys of Alaska's Department of Natural Resources. (Photo made and contributed by John W.

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chanics is 50 pages long, yet it contains only three pages on the forces that drive plate mo tion (compared with five on Stokes flow). The discussion of post glacial rebound in this chapter has a clear treatment of the response of a semi-infinite, viscous half space to harmonic loads, but gives harely any discussion of the constraints on mantle viscosity which

have been inferred from rebound studies.

There are a few areas that are not treated dequately: seismology is mentioned seven times in the book (six times in passing, including once in the preface where it is acknowledged that the lactina exists). It is quite true, as the authors state, that a full treatment of seismology would unduly lengthen an already long book, but a brief mention of the information that focal mechanism solutions have given us would not seem inappropriate in a textbook on geodynamics. Indeed, the observational basis for much of the subject is given less weight than we might expect. Other aspects of the subject will doubtless appear to different people to have been given less than their due, but it would be a brave person who would claim to have a perfectly balanced view of a subject that is evolving as rapidly as geodynamics.

In summary, many people will want this book because it collects a lot of material that is useful to the graduate and undergraduate student, as well as to the professional, but the key to the substance of this book lies in its subtitle rather than in its title.

Philip England is at the Department of Geological Sciences, Harvard University, Hoffman Laboratory, Cambridge, Mass.

New Publications

Items listed in New Publications can be ordered directly from the publisher; they are not available through AGU.

Inertial Rapid Geodetic Survey System (RGSS) Exrur Models and Network Adjustment,]. Hannah, Final Report, Part 11, Report 832, Ohio State University, Columbus, vii + 104

Irrigation Economics in Poor Countries, Illustrated by the Usangu Plains of Tunzania, A. Hazlewood and I. Livingstone, Pergamon, New York, viii + 144 pp., 1982, \$25. Comaintes, N. T. Arndt and E. G. Nisber

(eds.), George Allen & Unwin, Boston, xvii + 526 pp., Y982, \$75.

Mathematical Modelling of the Behavior of the La-coste and Rumberg "G" Gravity Meter for Use in Gravity Network Adjustments and Data Analyses, L. A. Krieg, Report 321 (AFL-TR-81-0330), Ohio State University Department of Geodetic Science and Surveying, Columbus, xii + 172 pp., 1981. Negev: Land, Water, and Life in a Desert Environment, D. Hillel, Praeger, New York, xx

+ 270 pp., 1982. Oceanography: The Present and Future, P. G. Brewer (ed.), Springer-Verlag, New York, xii + 392 pp., 1983.

Problems of The Arctic and the Antarctic Collection of Articles, vols. 39, 50, 52, 54, A. F. Treshnikov (ed.-in-chief), translated from Russian, available from National Technical Information Service, Springfield, Va.,

Proceedings of the Fourth Symposium on Coordinated Observations of the lonosphere and the Magnetosphere in the Polar Regions, T. Nagata (ed.), Memoirs of National Institute of Polar Research Special Issue No. 22, National Institute of Polar Research, Tokyo,

Seismic Migration: Imaging of Acoustic Energy by Wave Field Extrapolation, A., Theoretical As-pects, A. J. Berkhout, Developments in Solid Earth Geophysics, vol. 14A, Elsevier, New

York, xiv + 351 pp., 1982, \$59.50. Summary of the Results from the OSU Analysis of Seasal Altimeter Data, R. H. Rapp, Report 335, Ohio State University Department of Geodetic Science and Surveying, Columbus, v + 19 pp., 1982.



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Upper Ocean Physical Modeller. A postdoctoral position in upper ocean equatorial modelling supported by NSF is available in the Mesoscale Air-Sea Interaction Group at the Florida State University. Minimum salary is \$21,000/yr. Qualified Ph.D. should send vita and names of 3 references to Professor James J. O'Brien, The Florida State University, Tallahassee, FL 32506, or call (904) 644-4581.

Assistant Administrator for Oceanic and Atmospheric Research. The Office of Oceanic and Atmospheric Research (OAR), National Oceanic and Atmospheric Research (OAR), National Oceanic and Atmospheric Administration (NOAA), has announced the vacancy of Assistant Administrator for Oceanic and Atmospheric Research, located in Rockville, Maryland. The Office of Oceanic and Atmospheric Research is responsible for an integrated NOAA oceanic and atmospheric research and development program. The program consists of laboratory and extramural research projects that are relevant to NOAA service and resource management programs, and that provide sound technological and scientific principles on which to base improvements of those services and products. The Assistant Administrator is responsible for the direction and administrator is responsible for the direction and administration of all scitivities within OAR including the management of a coordinated research program Administrator is responsible for the direction and administration of all activities within OAR including the management of a coordinated research program that will ensure OAR's compatibility and effectiveness in serving NOAA's programmatic needs. Incumbent is responsible for effecting a research program in support of NOAA services including cognizance over all agency research, management of inhouse non-fisheries laboratories, and maintenance of a balanced, externally conducted, research and development program which complements in-house research efforts. The Assistant Administrator promotes the transfer of research results and new technology to other components of NOAA and, as appropriate, to scientific organizations outside NOAA. He'she advises the Administrator on the need for and efficiency of NOAA's tolal research and technology development effort, QUALIFICATIONS: This is an exciting and challenging opportunity for an individual with demonstrated knowledge of (1) oceanographic, moteorological, environmental, physical and/or engineering sciences (including at least 24 senester hours in physical science and/or closely related engineering sciences (including at least 24 senester hours in physical science and/or closely related engineering science is nequired. SALARY: This position will be filled under the Senior Executive Service (SES). Salany could range from \$56,945 to \$67,200 per annum. APPLICATION: Interested persons should call the NOAA Headquarters Personnel Section, 301-443-8378, to receive a copy of the complete vacancy announcement and qualification requirements. Applicants must also send a U.S. Standard Form 171, Personal Qualifications Statement, to Mrs. Susan D. Cisar, Personnel Management Specialist, Headquarters Personnel Section, AT/PER11, NOAA, 6001 Executive Boulevard, Rockville, Maryland 20852 by April 22, 1985. The Department of Commerce, National Oceanic serial, Arrivand 20852 by April 22, 1983. The Department of Continette, National Occunic and Atmospheric Administration is an equal oppor-

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Geophysicist. The Air Force Technical Applications Center (AFTAC) is seeking candidates for a staff geophysicist to supervise research in nuclear test detection seismology and hydroacoustics. Duties include In-house research on discrimination between earthquakes and explosions, technical supervision of contractor research and advising management in the candidate's area of expertise. AFTAC is located at Patrick AFB, Florida. Grade level GS-1313–13, salary \$34,930. Send a current SF 171 by March 31, 1983 to Huntsville Area Office, Office of Personnel Management, Southerland Bidg., 806 Governors Drive, S.W., Hunstville, AL 35801. For more information, call C. Thirlwell (305) 494-7663. Equal Opportunity Employer.

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Applicants should send a resume and the names of three references to: Dr. Thomas C. Hinkson, Head, Department of Physical Sciences, P.O. Box T-69, Tarkton State University, Stephenville, Texas 76-102. Telephone 817/808-91-43.

The deadline for application is April 15, 1983.

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The person obtaining the appointment would be responsible for a portion of the planning and execution of the field study, much of the subsequent data analysis and interpretation, and teaching of one graduate level course in physical oceanography each year. The successful applicant must have received the Pla.D. in physical oceanography or a closely related field by the starting date of his appointment. Preference will be given to applicants with direct experience in field observations.

To apply send a complete resume and the names of three references to Professor R. W. Garvine, College of Marine Studies, University of Delaware, Newark, DE. 19711. (Telephone: (302) 738-2160),

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It was decided that the best way to solve

the problems and to also face the growing competition to the journals was to meet challenges head on. A new journal would be

Starting a new journal is a major commit-ment, not to be undertaken lightly. The new publication would be a specialty journal with a limited number of printed pages per year. There would be no page charges; as a result, subscription rates would necessarily be higher per page than for the Journal of Geophysical Research ([GR) since there would be no other source of financial support. It was also decided that the journal would have a truly international focus, like the branch of science it was developed to serve. A joint publishing agreement was struck with the European Geophysical Society, and an editor for Europe and one for North America were appointed to serve with the Editor-in-Chief.

The official go-ahead came on May 24, 1981, with the first issue of Tectonics scheduled to be mailed in February 1982. This is an extraordinarily short lead time for beginning a new journal and Tectonics suffered some growing pains as a result.

Despite the hurried preparations, year I was marked by significant successes. Member response was particularly gratifying, with more than twice the projected subscriptions being placed. Library subscriptions met the modest amount budgeted for them. We know that many libraries had aheady committed their 1982 subscription budget before they received announcements of Tectonics. More library subscriptions are needed to provide the level of acceptance we expect for an AGU journal, and staft is committed to developing this subscription base.

The short lead time for the first issue and the field schedules of many potential authors created difficulties with the manuscript flow. Despite these factors the number of pages printed in the first year was within 5% of the projected page budget. International representation among the authors was a primary objective; year I found 7 countries represented in the list of authors of the 31 articles.

Another objective was speed of publication. The median time from acceptance of papers to the actual mailing of printed issues was 12 to 14 weeks. With a more neady manuscript flow this range can be trimmed. The production time for Tectonics in 1982 was actually faster than for JGR.

We cannot overlook finances as another measure of success. The proposal for this journal called for breakeven by year 3, the standard for commercial and university presses at that time. Today these publishers are considering breakeven in year 5 to be a satisfactory position for a new journal. We reached breakeven on direct expenses in year 1. This is a very successful financial position for a new venture particularly one with a single income source

Looking ahead to year 2 the editors and staff have changed some features to make Tectonics an even more attractive medium for publication. Longer manuscripts are clearly in the offing for this journal, but without page charge support the total number of pages cannot simply be adjusted upward to allow for these longer papers. Therefore, to accommodate these papers, the trim size will be enlarged to that of JGR to provide more

words per page.

Those involved in tectonic research require maps and oversized figures to adequately convey the science; these maps and figures will be printed in Tectonics, and the larger trim size will allow us to handle them more satisfactorily. Also, when necessary, either foldouts or maps in a pocket will be included, the additional costs for which must be defrayed by support from the authors' institu-

Critics of the Tectoures proposal were concerned about the scientific scope of the journal. Tectorics is carving out a niche for fiself different from that of JCR. Some evolution in the original statement of editorial scope is expected as the journal matures. It is clear that the research Tectonics is designed to convey is in fact being done. More and more projects that represent a true melding of traditional geology and geophysics are under way. These papers are ideal for *Tectonics*.

As we review year 1, we are well pleased with the successes our fledgling journal has made. We have learned much from this year and we look forward to the reaction of authors and readers to the changes introduced for year 2.

Judy C. Holoviak

JGR Red Slates Special Issue

The red-covered section of the Journal of Geophysical Research (JGR) is planning a special issue in recognition of Tom Crough's outstanding contributions to solid earth geophysics. An August I, 1983, deadline has been set for submission of papers to this issue. Anyone desiring to contribute a paper on a subject closely related to Tom Crough's research interests should notify JGR Red Editor Gerald Schubert by letter, stating a tentative title or research topic and estimated date of manuscript submission. Send correspondence to

Gerald Schubert Department of Earth and Space Sciences University of California, Los Angeles Los Angeles, CA 90024.

Through June 1983 send a duplicate of California correspondence to

Gerald Schubert Journal of Geophysical Research Geology Department The Hebrew University of Jerusalem

Membership **Applications** Received

Applications for membership have been re-ceived from the following individuals. The letter after the name denotes the proposed primary section affiliation; the letter A denotes the Atmospheric Sciences section, which was formerly the Meteorology section.

Regular Member

Philip B. Bedient (H), Steven G. Buchberger (H), Carl M. Bunker (V), Roger W. Burke (O), William H. Busch (O), Daniel Ca det (A), Sandral Daniell (G), Steve Denahan (H), Douglas W. Duncan (T), John C. Ger-Jach (A), Ernest C. Hauser (T), Bruce B. Hicks (A), Mary C. Hill (H), Donald Jorgensen (H), Randy D. Klein (H).

David C. Lanigan (T), Long C. Lee (A), G. Wesley Lockwood (A), Vicente L. Lopes (H), Gottfried P. Maxerath (A), Carl J. Michelsen (V), Louis Nash (O), Masahiro Osako (T), Stan Oworki (SS), Terry J. Shackelford (T), Ellen D. Smith (H), Charles R. Stern (V), Albert A. Tomko (SA). Philip L. Wagner (V). David C. Woods (A), Thomas Yelm (S). Christos S. Zeretos.

Student Member

Media

Kathleen Ahlenius (V), Obiora Pat Aliboh (H), Roy Burger (S), Leslic Burke, Kevin Campbell, David B. Cook (T), Frederick A.

AGU Congressional Science **Fellowship**

The individual selected will spend a year on the staff of a congressional committee or a House or Senate member, advising on a wide range of scientific issues as they pertain to public policy questions.

Prospective applicants should have a broad background in science and be articulate, literate, flexible, and able to work well with people from diverse professional backgrounds. Prior experience in public policy is not necessary, although such experience and/or a demonstrable interest in applying science to the solution of public problems is desirable. The fellowship carries with it a sti-

pend of up to \$27,000, plus travel alowance. '

Interested candidates should submit a letter of intent, a curriculum vitae, and three letters of recommendation to AGU. For further details, write or call Member Programs Division, Congressional Fellowship Program, American Geophysical Union, 2000 Florida Avenue, N.W., Washington, D.C. 20009 (telephone: 462-6903 or 800-424-2488 outside the Washington, D.C. area).

Deadline: March 31, 1983

Dube (GP), Lisa G. DuBois (O), Donald S. Dunbai (O), John Eberlin, Daniel James Genoshe (S), Dian Gifford (O), Jodi L. Gorden (P), Karen Gray (V), Randy F. Greb (H), F. Bryan Grigsby (I), Gary E. Hokkanen (H), James A. Howe (G), Dan Jansen (T), Ralph F. Keeling (A), Kevin Kremk (S), Kim Kroeger

Jeffrey Lee (T), David M. Levy (O), Jian Lin (T), Shu-Wang Liu (GP), David G. Liver-more (H), Ned T. Marks (H), Osamu Matsubayashi (T), Daniel J. Mclendez Alvira (SA), Joseph A. Mihalko (G), Jay P. Mitchell (S), James N. Nmoum (O), Terrance G. Onsager (SM), Jim Rothove (G). Charles E. Savida (O), Diana Seely (H), Steven F. Siwiec (H), Daniel Steinberg (SS), Jack Walker (G), Chuching Wang (H), B. Kevin Wood (V).

Associate Member

Joaquin Ruiz (V), Thomas J. Suchoski (H).

<u>Meetinas</u>

Announcements Gordon Research Conferences

Six of the 107 Gordon Research Conferences scheduled for June 13 to August 26, 1983, in New Hampshire should be of interest to geophysicists. 'Dynamics of Gas-Surface Interactions' is planned for August 1-5 at the Plymouth State College (North); Environmental Sciences: Air Biogeochemical Cycles and the Atmosphere' is slated for June 20–24 at the New Hampton School in New Hampton; 'Space Plasma Physics' (subtitled 'Outstanding Problems in the Magnetosphereonosphere-Atmosphere System') will be held une 13-17 at the Plymouth State College (South) in Plymouth; 'Inorganic Geochemis-try' (subtitled Quantification of Petrologic rocesses) is slated for August 22-26 at the Holderness School in Plymouth; 'Fluids in Permeable Media: Physics and Chemistry' is planned for July 25-29 at the Tilton School in Tilton; and 'Molten Salts and Metals' is slated for August 22–26 at the Brewster Academy in Wolfeboro.

The Gordon Research Conferences, begun 52 years ago, state as their exclusive purpose the fostering and promoting of education and science through the free and informal exchange of ideas among participants. The complete program for the 1983 Gordon Research Conferences is published in *Science*, March 4, 1983.

Interested persons seeking applications and additional information should contact Alexander M. Cruickshank, Director, Gordon Research Conferences, University of Rhode Island, Kingston, R1 02881 (telephone: 401-783-4011 or 783-3372). Attendance at each conference is limited to 100 participants, so early registration is encouraged. Mail for the office of the Director from June 13 to August 26 should be forwarded to Colby-Sawyer College, New London, NH 03257 (telephone: 603-526-2870).

Lake Superior Geology

The 29th Annual Meeting of the Institute on Lake Superior Geology will be held in Houghton, Mich., May 11–15, 1983. All aspecis of the geology surrounding Lake Superior will be discussed; special emphasis will be on Precambrian silver and gold mineralization. An award will be made for the best paper written and delivered by a student.

Two field trips also are planned: one to look at the geology of the Keweenaw Peninsula and the other to look at the geology of the Ropes Gold Mine and the Deer Lake pe-

Registration forms and additional information may be obtained by writing to the conference chairman, T. J. Bornhorst, Department of Geology and Geological Engineering, Michigan Technological University. Houghton, MI 49981.

Atmospheric Tides

A I-day workshop on 'Tides in the Mesosphere and Lower Thermosphere' will be held August 17, 1985, at the International Union of Geodesy and Geophysics General Assembly in Hamburg, FRG. The session is targeted at theoreticians, experimenters, and data analysts involved in tides research. Analysis and interpretation of wind measurements recorded during the November 1981 global servational campaign will be the main top-

For additional information contact Jeffrey M. Forbes, Department of Physics, Boston College, Chestnut Hill, MA 02167 (telephone: 617-969-0100).

Organizers of the workshop are the International Association of Meteorology and At-mospheric Physics (IAMAP) and the ICMUA (IAMAP Commission on Meteorology of the Upper Atmosphere) Working Group on Tides in the Mesosphere and Lower Thermo-

Meeting Report Mechanics of Fluids in Porous

Transport of quantities such as mass component of a phase and/or heat occurs in fields as diversified as petroleum reservoir engineering, groundwater hydraulics, soil mechanics, industrial filtration, water purification, wastewater treatment, soil drainage and rrigation, and geothermal energy production. In all these areas, scientists, engineers. and planners make use of mathematical models; these models describe the relevant transport processes that occur within controlled porous medium domains and enable forecasting of the future behavior of these domains in response to planned activities. The mathe-matical models, in turn, are based on the un-

derstanding of phenomena, often within the void space, and on theories that relate these phenomena to measurable quantities. Because of the pressing needs in areas of practical interest such as the development of groundwater energy storage and geothermal energy production, a vast amount of research in all these fields has contributed, especially in the last two decades, to our understanding and ability to describe transport phenomena in porous media. In recent years these research efforts have been significantly accelerated, attracting scientists from many disciplines. The practical needs of solving boundary value problems in heterogeneous domains, irregular boundaries, coupled plienomena and multiple dependent variables led to the development of a variety of powerful numerical techniques. The realization that fields are highly lieterogeneous and that the degree of heterogeneity depends on the scale of the problem led to the introduction of sto-

chastic concepts as an additional tool for the

A meeting devoted to interdisciplinary consideration of this entire field was convened by J. Bear and M. Y. Corapcioglu under the auspices of a NATO Advanced Study Institute held July 18-27, 1982, at the University of Delaware, Newark. Attended by 85 scientists from 21 countries, the meeting addressed recent advances in research on transport phenomena in porous media, with special emphasis on the frontiers of knowledge in this area and on a unified approach by scientists coming from different disciplines. Lectures covered four main topics: fundamentals of transport processes, porous medium deformation, the stochastic approach, and numeri-

The first part of the meeting was devoted

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пате, address and phone number

American Geophysical Union 2000 Florida Ave., N.W. Washington, D.C. 20009 Attention: T-shirt slogan

109

power spectrum of waves must be steeper than $\gamma \geq 4.7$, where γ is the power-law spectral index. Ions of exygen or tren, with larger mass-per-charge ratios are accelerated more resulty than helium, but still require steeper spectra than are observed. This model is also unable to produce the mass-proportional heavy ion temperatures that are absenved. We show that the production of mass-proportional temperatures is inconsistent with proferential acceleration of heavy ions by this mechanism. The model also produces a heavy lon-to-proton resperature ratio at 1 AU which is anticorrelated with solar wind speed, in contradiction with the observed behavior. (Solar wind heavy ions, wave-particle interactions, solar wind acceleration)

J. Geophys. Rus., Blue, Paper 3A0337

Ionosphere

dave lupeant, O2 emission)

REGITTOLOW

Particles and Fields-

5505 Afralow
THE ROTATIONALLY-RESOLVED 3490-1800 & TERRESTRIAL

T. G. Slangor and D. L. Huestis (Molecular Physics

Laboratory, SRI International, Memlo Park, California

Analysis and synthesis have been performed on

partions of unpublished ground-based nightglow spectra

The bands of the three O2 systems radiating in the

that dominates the visible Venuetan nightglow, ere

clearly identified. (Airgine, nightgine, rotational

taken at ~ 0.5 A resolution by A. L. Brandfoot in 1969.

3400-3800 A region are rotationally resolved, and lines

MAIS Auroras
RESPONSE OF NIGHTSIDE AUBORAL-OVAL BOUNDARIES TO THE
RESPONSE OF NIGHTSIDE AUBORAL-OVAL BOUNDARIES TO THE
RYPEPLASTARY MAGNETIC FIELD
B. Nakal and Y. Kamide (MOAA Space Environment
Laboratory, 123 Broadway (NIGHES), Soulder, CO 80303)
The poleward and equatorward boundaries of the mightside survail oval are scaled from BNIT auroral imagery
and their response to the interplanetary magnetic field
(HW) is inventigated. Although, as expected, the h
component of the HW is found to be the dominant
factor in determining the latitude of the oval equatorward boundary, the corrolation coefficients are not very
high: the large variance results from the considerable
acetter of points when the HW is morthward and large.
By examining the ownloandaries from successive orbits,
it is suggested that cost of the "expended" oval cases
during such northward HW periods occurred withhan
soveral hours after periods of southward HW. This
indicates that the response of the oval to northward
turnings (i.e., the contraction of the oval takes place
rather slowly, we that the contracted oval to its scalicet size can be setablished only when the HW has a
morthward component steedily for zore than soveral
hours. The observed oval quencoward boundary is
mapped onto the equatorward plane of the magnetorall,
and then plasma sheet processes are discussed with reapect to present theories on the formation of the
Alfvén layer as a result of the penetration of soiar
whole observed fields into the magnetotail. (Interplanetary magnetic field, surveras).
J. Coophys. Peac., Blue, Paper 180112

from three different clr. + x3rg hands, the system

to the development of the fundamental equations of balance of mass, momentum, and energy in a porous medium, where the latter is viewed as a continuum. Two methods were presented for obtaining these equations in the case of multiphase (and possibly multicomponent) flow in a (possibly) deformable porous medium: the mixture theory and a theory based on volume averaging. In the larter case, the averaging is over a representative elementary volume of the porous medium, of the equations of balance of the considered extensive quantities, written at the inicroscopic level, that is, at a point within an individual phase present in the system.

When this approach is applied to the equa-tion describing momentum balance, subject to certain assumptions including low Reynolds number, Darcy's law is obtained. As the Reynolds number is increased, the flow regime changes until full turbulence is reached. This phenomenon—as it actually occurs within the pore space—was demonstrated by using advanced laser monitoring and photographing techniques. Multipliase flow problems were introduced by a discussion on infiltration. The multimedia approach of handling heterogeneities in aquifer systems—applicable to both leaky aquifers as well as to fractured porous media-was demonstrated by considering the hydraulics of wells in heterogeneous porous media.

In the second part of the meeting, theories on porous medium deformability under saturated and unsaturated soil conditions were reviewed, with special attention focused on the subject of consolidation in aquifers. One of the major reviewed topics was Biot's theory, which underlay many of the presentations. Various constitute equations representing nonelastic behavior were presented and discussed. A methodology was presented for dealing with the problem of land subsidence and horizontal displacements which result from pumping from an aquifer.

The usual continuum approach and the macroscopic equations derived by employing it fail to describe transport phenomena when dealing with Lugescale problems in aquifers; this results from the large variability in transport and storage properties of the considered domains. The solution of transport phenomena in domains with such heterogeneities,

which always exist and on which information is available only in statistical forms, requires a special method of treatment—the stochastic approach. Two papers were presented which represent a frontier in research efforts on this important subject.

Once a mathematical model—or a wellposed boundary value problem-is establisted as a satisfactory representation of a process, its solution for cases of practical interest usually calls for a numerical technique. This is because of the heterogeneity of the domain, the irregularity of its boundries, nonlinearity of the problem, and other factors which preclude the possibility of an analytical solution. Several advanced numerical methods, especially ones involving finite elements, were presented and compared. Of special interest is the conjugate gradient method, which facilitates the treatment of very large problems; it was demonstrated for problems of flow and land subsidence.

A proceedings volume containing the lectures presented at the NATO Advanced Study Institute is in preparation and will be published by Martinus Nijhoff Publishers BV. The Hague, The Netherlands. In the meantime, further details of the meeting may be obtained from either J. Bear or M. Y. Corap-

This report was prepared by Jacob Bear of the Department of Civil Engineering, Technion-Israel Institute of Technology, Technion City-Haifa, Israel 32000 and M. Yavuz Corapcioglu of the Department of Civil Engineering, University of Delaware, Newark, Delaware 19711.

Geophysical Year

New Listings

The complete Geophysical Year last appeared in the December 21, 1982, Eas. A boldface meeting title indicates sponsorship or cosponsorship by AGU.

May 11-15, 1983 29th Annual Meeting, Institute on Lake Superior Geology, Houghton, Mich. (T. J. Bornhorst, DepartAhoy! Sail Back into Baltimore

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call toll free 1-800-241-0243 (Georgia residents 1-800-282-8536)

Plan a Memorial Day weekend hollday in Baltimore there's lots to dol

Airline, registration, and housing material was published in Eos, February 8.

1983

AGU

Spring

Meeting

Contact AGU Meetings 2000 Florida Avenue, N.W., Washington, D.C. 20009 (202) 462-6903 D.C. area, (toll free) 800-424-2488

ment of Geology and Geological Engineering, Michigan Technological University, Houghton, MI 49931.)

June 13-August 26, 1983 Gordon Rcsearch Conferences, various sites in New Hampshire. (Alexander M. Cruickshank, Director, Gordon Research Conferences, University of Rhode Island, Kingston, RI 02881; telephone: 401-783-4011 or 783-3372.)

October 31-November 2, 1983 Shuttle Environment and Operations, Washington, D.C. Sponsor, American Institute of Aeronautics and Astronautics. (AIAA, Meeting Department, 1290 Avenue of the Americas, New York, NY 10019)

November 14-17, 1983 Seventh International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, Mass. Sponsor, Materials Research Society. (Gary L. McVay, Materials Department, Battelle Northwest Laboratories, P.O. Box 999, Richland, WA 99352; telephone: 509-375-376% November 16-18, 1983 Third Applied Climatology Conference, Hot Springs, Ark. Cosponsors, Committee on Probability and Statistics and Applied Climate Committee of the American Meteorological Society, (Send all abstracts to Wayne M. Wendland, Illinois State Water Survey, P.O. Box 5050, Station A, Champaign, 11, 61820.)

Correction

The title of the following meeting has been revised since its listing in the February 8, 1983, Em.

October 3-7, 1983 Chapman Conference on Magnetic Reconnection, Los Alamos National Laboratory, Los Alamos, N.M. (Meeings, AGU, 2000 Florida Avenue, N.W., Washington, DC 20009.)

Separates

To Order: The order number can be found at the end of each abstract; use all digits when ordering. Only papers with order numbers are available from AGU. Cost: \$3.50 for the first article and \$1.00 for each additional article in the same order. Payment must accompany order. Deposit accounts available.

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Aeronomy

EFFECT OF RECENT PATE DATA REVISIONS ON STRATOSPHERIC Nation K.W. Fo and Mion Dak Sze (Atmospheric and Environmental Fessarch, Enc., Sed Memorial Drive, Cambridge, MA 02139)

Earbridge, M. 07139)
Incorporation of recent revisions in rate date for several key reactions (MASA-PPL, 1982) into our L-D andol leads to bigher ON concentration in the upper stratosphere. Accordingly, the calculated upper stratosphere is concentration to higher and appears to be in butter agreement with observations. However, the calculated propent day upper stratospheric excented concentration is adjusted by the calculated propent day upper stratospheric excented concentration is adjusted to the factor rate for d *No., It is whom that the use of mailtred proper server. magner was and Clo and thur faster rate for d 4 Mag. It is whom that the use of smilter dy cross-section in the light seek lover occurrence in a major is trainsphere, causing further detection in the upper is rainsphere, causing further detections. The effects of the row rate does not be executed as the country of the row rate does not be calculated as early state occurred position due to release of City are discussed. (Stratospheric medaling, stratospheric dis, stratospheric (D, stratospheric di).

Geochemistry

1410 (tentary of the atmosphere

Wiffield Alto Warden REPRATIONS FROM MEGATIVE ION COMPOSITION DATA REPUBLY 25 AND U. PM.

5. Artis. D. Navelane, J. Ingels and P. Frederith

(Religian insattate for Space Arronay, Ringless, 3

8-1180 Strussels, Religion)

Strate spheric negative ion composition data obtained

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1499 Mincellaneau (Chaminery of Fracipitation)
MASSUMPREST OF MASS OPERAND AUDIT TH PRESTRIATION
FROM EMPTE Arias Of THE WORLD
S. G. Kesna, J. F. Gallovay and J. D. Raiden
(Separiment of Engloquespent Rejenter, University of
Virginia, Charlottaguille, Wirginia 22903)
The Gabal Presipitation Englant 22903
The Gabal Presipitation Chiminery Project collects
pecclystation by event of detaining the composition or
presipitation, and produced that control it is five
tobate register. Inch balancer hand on saiper socrandir
upecias revealed considerant anion deficits at critain
also. This sid other avidance supported that wast

organic acids contributed to free scidity. Accurate and pracise techniques were developed to measure organic anions and cotal acidity in pracipitation. Twelve mamples from a remote site were analyzed for unjor organic and inorganic chealest constituants. Formic and acutic acids were found in all aliquous which had been treated with a blocide. The disappearance of chase acids from untreated sliquots corresponded to a proportionate decrease in free acidity. Weak organic acids contributed 64% of free acidity and 65% of total acidity to precipitation during part of the 1981-82 were assens at Katherine, Australia. Unmeasured proton donors contributed 21% of total acidity during the period. (Precipitation chamistry, organic acids, acidity, remore regions).

J. Geophys. Res., Green, Paper 100341

1299 General (Chanistry of Seditants)

**Be AND Be IN THE MAURICE RIVES-UNION LAKE SYSTEM OF
SOUTHERN MEW MESSY
L. Lundberg, T. Tirich, G.F. Berzog (Department of
Cumdetry, Rusgers University, Rew Brunswick, New
Jersey, U8903), T. Sughus, G. Ashley, R.F. Wontor,
C. Tuniz, T. Kruse and W. Seul
The **Be and Be contents of 22 samples taken from 7
locations in the Newrice River-Union Lake system of
southern New Jersey are reported. Bulk **De contents
range from 0.05 to 2.7 dop/kg and Be from 0.1 to 2 ppm.
5611cate minerals separated from Union Lake sediments
appear to have a constant surface concentration of
'3 x 10" stom '*Bo/ca*' Organic material is greatly
maritched in Bul hand-picked acoptes content ower 10
dop/kg of 'Se and 5 ppm of Se. The deposition rate of
'18e in Union Lake is wit atom'ro*-sec. (**Be, Be,
J. Complya, Ress. From Reservations.

J. Geophya. Res., Green, Paper 360316

Geodesy and Gravity

1910 Crustal Movements
A DISLOCATION ROBEL OF STRAIN ACCIMULATION AND RELEASE
ALL A SUBJUCTION ZONE
J.C. Savage (U.s. Geological Survey, Medio Park, CA

94025)
Strain accusulation and release at a subduction zone are attributed to stick-wilp on the cain thrust some and statistics. This process can be described as superposition of stoady-state subduction and a repetitive type of site on the suin thrust some constating of steady normal site at the plate convergence rate plus occasional thrust avenue that recover the accumulation of steady normal site at the plate convergence rate plus occasional thrust avenue that recover the accumulation normal site. consisting of steady normal with at the plate convolgence rate plus accasional throat swants that recover to accumulated normal with. Secondary state subjection does not contribute to the decimalist of the state of contribute to the decimalism at the free surface, deformation observed there is completely equivalent to the produced by the alip cycle slows. The response to that with is simply the response of a particular earth model to swanded dislocations. For a purely elastic march model, the deformation cycle consists of a coselent offers followed by a linear-in-time recovery to the initial value during the interval between earthquakes. For an viscoslantic earth model (steatte lithosphere over a viscoslantic earth model to the indicate that the languater post stead of the indicate that the languater post stead of the indicate that the languater post stead of the standard of least the deformation consists of the safety state of the standard of the standard of the safety state of the safety of the could be suplated if stick-slip were postulated to retain slong the suplations of parhaps 100 tos, but independent authorial estimates that exist-mile at upth depthe is antitudy. (Strein eccasulation, subjections dislocation).

J. Geophyn. Rem., Red. Paper 180318

1990 instruments and Tachniques (Insrtini Gaodamy)
IMENTIAL SURVEXING AND GEODESY
K. P. Schwarz (Division of Surveying Engineering,
The University of Caigary, Caigary, Atta., 738 NA
Insrtial survey, systems offer a novel and in
many ways, unique approach to the geodetic profloss of positioning and gravity field detaining
tion. The paper outlines the badic theory of
using the output of an insertial mesoring matrix to
obtain geodetically meaningful results. Baphesis
is on the development of appropriate machinestical
module and detination procedules rether than on

J. Geophys. Ram., Rad, Paper 380338

hardware aspects. A discussion of results achieved to dets and an outlook on future applications continue aspects the presentation. (Inertial survey systems, positioning, snowalous gravity field, geodesy). Rev. Geophys. Space Phys., Paper 3RO343

Meteorology

3715 Chemical composition and chemical interactions COMPARISON OF AIRBORNE CO. FLASK SAMPLES AND NEASURE-MENTS FROM THE MAURA LOA GREERVATORY DURING THE HAVEC PROJECT (JUNE 1980).

1. A. Herbart (Geophysical Monitoring for Climatic Change, NOAA, Boulder, CO, 80303) and T. B. Harris.

1. F. S. Chin (Mauna Loa Observatory, GMCC, NOAA, Hilo, MI. 96720

J. F. S. Chin (Hauna Los Observatory, GMCC, NOAA, Hilo, M.) 9670.

During June 1980, the Hawaii Mesoscale Energy and Climate Project (HAMEC) Field program was conducted in the vicinity of the Island of Hawaii. The abjective of the program was to use the NOAA PJ aircraft to measure meteorological variables unwind and downlind of the island to provide data to avaluate mesoscale models of airflow and cloud physics. One specific objective was to obtain flask samples upwind of the island to confirm that the CO, values observed at the fauna Los Observatory (MLO) afer representative of the free air at comparable mittudes. On two days, carbon dioxide flask samples were exposed aboard the aircraft at the altitude of the observatory and immediately above the trade inversion. Flask pairs in reasonable agreement were obtained on both occasions. During the same period of time the sampling conditions at MLO were free of obvious local contamination. The average difference between the aircraft measurements at the aititude of the observatory and the continuous CO, record from the observatory over the same period of time was D.8 mole fraction in pape. Differences in the individual measurements are discussed with respect to prevailing meteorological conditions.

3715 Chemical Company and the conditions.

3715 Chamical Composition and Chamical INTERFECTIONS
ORGANIC FILES OF ATMOSPHERIC AZROSOL PARTICLES,
POO PROPLETS, CLOUD DROPLETS, SAINDROPS, AND

POG DROPLETS, CLOUD DROPLETS, RAINTROPS, AND SKORTLARES, P. S. Giti, T. E. Greadel (Bell Laboratories, P. S. Giti, T. E. Greadel (Bell Laboratories, Patrices active organic molecules are common constituents of atmospheric serosol particles, reindrops, and smowliskas. If these compounds are present as surface films, transfer of games into the almospheric water systems could be lapeded, wapporation could be almospheric towards and the aqueous chesical reactions could be influenced. To investigate these possibilities, we have reviewed the chemical literature partaining to organic films on squeene surfaces; their composi-

Physics of the Solid Earth Volume 18. Number 3

Novikov V. L. Extremal-velocities structure of advective tectonic motions .

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SCIENTIFIC COMMUNICATIONS

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polarization of conducting ellipsoidal inclusions

tion, extractore, properties, and offects. We then review the confidence of the organic compounds in atmospheric series. On expent the treats of non-measurements of number of condens of development, argain compounds (helphone, n-he-and), output, and another) and demonstrate that the compounds proved in the with properties above of these of Another) and demonstrate that the compounds pro-duce films with propertion abother to those of the more well become any facture. We reached that argente films are probably common on almos-pherts, normal particles and that they may occur under regists, irramationed on cloud drop-lets, fog droplets, and anostiaken. If present, they will increase the literance or account particles, fog droplets, and rived droplets, both by inhibiting water vapor evaporation and by reducing the efficiency with which these alsos-pharte components are accounted. The process of the film will not come a significant reduc-tion. It appears likely, because, that the transport of general melecules into and out of the aqueous solution will be hapeded by factors of several bendred as mare when organic film are promise. Since incorporated pass molecules provide much of the catifying potential of atmospheric vaccy droplets, the organic films will play a solut role in droplet chestarry by atmosphy inhibiting melation agidation. Rev. Geophys. Space Phys., Vapur 200100

from the gas phase during the first 3 souths and from the gas phase during the first 3 souths spit sloilarity of the large particle profiles 2 nonths spit indicated continued particle growth 65 seaths effective required. By December, the aerosol layers had largely arrested to the latitude (41°M) of Largela. (Voiceple person), stratospheric sulfaric acid, El Chiabre effects). Geophys. Ros. Lett., Paper 31.0319

3770 Particles and occurring
ETRATONPHEASE RULFURIC ASID PRACTION AND HASS
ESTIMATE FOR THE 1982 VULCANIC EMPETOR OF EL BETHATE FOR THE 1982 VOLCANIC EMBPTION OF ECCICION.

B. J. Hofmann (Department of Physics and Astronomy, University of Myoming, Jaromic, Myoming, Goffin and J. M. Romen.

From Belloum-borne particle counter late at Larent (41°M) and in nonthern Texan (27-29°M), the total attractory bette means of the enriptions of Electron weight on with possibly as much en 20 Tg in the settled to be "8 Tg about 6's months after the scential of the observed in Toward was primarily in the layers, both highly volutile (, 98%) at 196°C. Ascept in the upper layer at "25 km was composed of an and in the upper layer at "15 km was composed of an and in the upper layer at 10 km at 1998 at 196°C. Ascept in the upper layer at 10 km at 1998 at 196°C. Ascept in the upper layer. An acty bi-codel layers are set in the upper layer. An acty bi-codel arms and droplets in the upper layer. An acty bi-codel layer in the size distribution suggested droplet sucleates.

AN = ()Al₂-81₂)/(Al₂+81₂)

y = (Qz-10Fs) or 0, whichever is greater

o.g. Di=Ca_{1/4}Hg_{1/4}El_{1/2}O_{3/2},

are mad to calculate b. This expression is a superior frequency of respectature compared to other faldspar-someters. (faldspar, liquid, geother-Geophys. Res. Lett., Paper 3L0202

4270 Properties of minerals KENYAITE - SYNTHESIS AND PROPERTIES

lache Chemie der Universität, Olehausenstr. 40/60, 2300 Kiel, Germany)

The hydrous modium silicate konymite can be synthesized from aquesus suspensions conteining SiO, and MacH with SiO,/MacH ratios ranging from 5 to 20 and H₂O/Ne/H ratios from 50 to 500 at 100°C - 150°C. This phase can nise to prepared from concentrated or diluted water glass solutions above 120°C. At 100°C masaddite generally provipitates as the first reaction product and them alters to venyaite. The stable end product is quartz. This leads to the augrestion of the transformation: mugadilto —— konyaite —— "uartz in agreement with field obsurvations of Eugster (1969). Synthetic konymites form spherical aggregator of well-developed plates. Kenyaite gives intracrystelline reactions like other layer silicates. Through exchanging protons for the luterlayer sodium lons kenyaite is transformed into a crystalline silleic acid. Am. Min., 68, 5-6.

ties of the ash from the 1992 M. Chichen druptions. These measurements were under an ash samples collected at three surface sites at distances between 12 and 80 km from the volcane. The measurement ample is inken us next representative of the silicate ash injected into the arracosphere. The measured optical properties are expressed as a complex refractive index m, with the served absorp-Am. Min., 68, 5-6.

*209 General (Regional Metacorphism)
FREESURE, TEMPERATURE, AND HATAMORPHIC CONATION STUDIES
OF PELITIC SCHISTS IN THE MERRIAGE SYNCLIDATION
SOUTH-CENTRAL HEN HAMPSHIRE
C. Fage Ghamboriain (Geology Department, Harvard
University, Cashidge, Mass., 62136) and J.B. Lyons
Metacorphic leograds in pullide works in the 15quadrangles in southorn New Hampshire are divisible
into the upper 5 of Tracy's (1975) high-grade cones;
2) the staurclite-silitranite zone. 3) the silitnanite
zone. 4) the silitnanite-silail feldapar sone and.
5) the silitnanite-silail feldapar cone and.
6) the silitnanite-silail feldapar zone and.
6) the silitnanite-silail feldapar zone and.
7) the silitnanite-silail feldapar zone rocks
stending from the Lowesell Mountain quadrangle to
the Moldarness quadrangle. This feature is later
than the atmost Lowesell Mountain quadrangle to
the Holdarness quadrangle. This feature is later
than the atmost Devonian Kinsonn and Spaulding
Beries plutons in this region.
Three stages of Acadian netacorphism are recognised.
An early, Eddapared, andsuluite grade sate-corphism,
M(1), is evidenced by an acandance of silitanite
pseudonorphe after obhastolite. A later, high-grade,
silitanite to cordierite-sikail feldapar grade
astacorphism, M(2), produced the doxinant languad
pattern. Pressures and temperatures during M(2)
metacorphism, were 4.5 - 1.5 kilobars and 450 to 800
0 2.25 (a based on gamet-plagicolese geolarmetry
and garnet-biotite geothermonetry. Calculated activities
of water, based on memorate and plagicolese equilibria,
fall sithin a marrow range suggesting that the activity
of water varied little during R(2) metacorphism, M(2)
assemblages were locally retrograded by M(3) cetacorphism,
producing otherite after biotite and garnot and a
lower temperature, decumente accounter. M(3)
metacorphism producy represents the rehydration and
retrystatilization of M(2) assemblages during dooling
following the peak of netacorphism. (Metacorphism, quite low values or assorptions with art at you have regging from 1.5x10⁻¹ for the 12 km sample to 1.0·10⁻¹ for the 80 km sample. Based on those measurements, we estimate that in for the strandarderic stiftent as the slave by n = 1.53 - 0.0011 incression, optical property of the strandard strandard strandard strandard strandard strandard strandard strandard.

3790 (Instruments and techniques)
COMPARISON OF TROPORAUSE LEIGHT AND FRONTAL SUURDARY
LOCATIONS BASED ON RADAR AND RADIOSONDE DATA
M. F. Larsan iSchool of Electrical Prepineering.
Cornell University, Ithaca, New York, 14853) and
J. Rättger
In Pahrusry of 1982 the SOUSY-VEF-Radar, located
near Hannowor, West Gormany, was operated during the
passage of a warm front. The timing of the radiosonde
ascent from nearby Hennover was such that the nerrow
frontal zone boundary was immediately overhead at a
height of approximately 7 km. The data from this
symm has made it possible to make a detailed comparison of the radar and radiosonde reflectivity data that
has not been possible before. We find that the
frontal boundary that is detected by the radar appears
as a very low tropopause height in the radiosonde data
(approximately 3 km less than the mean Juring this
time). (VMF radar, fronts).
Geophys. Res. Lett., Paper 310304

New Anglana, Gestnermozetry). Nm. Min., 68, 5-6

Oceanography

4713 · figuration

A713 inculation

KDDY FINETIC EMPROY IN THE MORTH ATLANTIC FROM SURFACE DEFFERS

P. I. Michardson (Department of Physical Oceanography, Moods Hole Oceanography Institution, Moods Hole Oceanography Institution of the near-surface currents in the Morth Atlantic, Mean velocity values and the velocity variance about the mean were calculated for different regions. A horisontal map of eddy Winstit energy was prepared on a 2° by 2° grid botween Lattudes 20°-55°M. Maximum eddy energy (w 1000 cm² sec²²) coincides with the high speed Guif Stroam jut where it begins large amplitude assandars near 17°M of "M. A tengue of high eddy energy coincides with the Stroam', path castward and as and the Grand Hanks into the Newfoundland Sein where values of 1000 cm² sec²² are found. A weater tongue oxtends essaward across the mid-Atlantic Ridge near 45°M. A accord weak extension reaches southeastward

ostends one-ward across the mid-Atlantic Ridgo near 43°N. A second weak extension reaches southeastward from the Stream and aroases the mid-Atlantic Ridge between 30-35°N. North and south of the Stream, addy warry diminishes capidly reaching an e-folding at 190 km from the axis. Values of 200 cm² sec²² were observed in the sid-eyes region and 100 cm² sec²² in the Eastern Forth Atlantic and Borth Equatorial Current. Although the gross distribution of eddy energy is similar to that determined from ship drift wassurements, there are significant differences. Eddy energy from drifters amounts to about twice the value massured by ship drift in the Quif Stream and one half the ship drift values in the mid-gyrs. It is buggested that these differences are due to the horisontal averaging of associate action and the arrors in navigation, both of which are problems with the ship drift technique. (Eddy kinetic energy, ourrents, Gulf Stream, drifting buoys).

J. Scophys. Ros., Groam, Paper 300349

J. Scophys. Ros., Groud, Paper 3CO249

473u Internal Wavas
WDRLS OF THE OCEANIC INTERNAL MAVE FIELD
Dirk J. Olbers (Hax-Pianck-Inglitut für Metcorologia, fundusett. 55, 2000 Hamburg 13, FRG)

nirk J. Olbers (has-Pianck-Institut für Matcordlogis, fundusert. 35, 2000 mabung 13, FRG)
Internal wave research has presented a variety of models describing the kinematical, spactral, and dynamical properties of the oceanic internal wave field. Kinematical models was the concept of standing modes as well as vertically propagating waves. In both approaches critical layer effects appear in the presence of an ambient shear flow. Spectral models have successfully beam developed for the wave field in the main thermocline which appears to be in a universal state. The properties of the upper ocean wave factor in the properties of the upper ocean wave factor in the properties of the upper ocean wave factor in the properties of the upper ocean wave factor in the properties of the upper ocean wave failed and mising rates of the ocean. The search for dynamical relations of the wave field to environmental conditions has been extensive. The lack of dynamical correspondences between the wave spectrum and possible forcing fields in observations suggest that forcing fields

In observations suggest that forcing is wask, theoretical models of wave generation show that many mechanisms may contribute with qual efficiency. In concert with the observed low dissipation rates in the desp ocean, these results point towards the conclusion that there is no dominant source of energy but weak forcing by many different sources and wost dissipation. Under such conditions the interrelation between forcing and dissipation as well as the spectral form is controlled by internal transfer by mane-wave interactions which are very efficient to rolar spectral distortions to the observed universal form. (Fiscentical models, spectral twofels, dynamical models, sunergy balance).

Ray, Geophys. Space Phys., Paper 380227

Rav. Geophys. Space Phys., Paper 380297

A765 Surface were tides, and sea level
on the MAYENDRES SPECTRUM OF OCEANIC MESOSCALE
VARIABILITY OBSERVED BY THE SEASAT ALTIMETER
1.—L. Fu (Jet Propulsion Leberatory, California
Institute of Technology, Pasadems, CA 91109).
The wariations of sea-murface height measured by
the Seasat slighter in nearly repeat orbits during the last 24 days of the Mission are used to
compute the wavenumber spectrum of seasocale
variability in various parts of the oceans. The
instrument noise jevel ("150 cm²/cycles/km) has
lisited the resulting oceanic spectrum to wavelengths longer than 100 km. It is found that
the characteristics of the oceanic spectrum are
dependent on the energy level of the mesoscale
variability. In the high-soursy areas close to
major current systems, most of the secrety de con-

veriability. In the high-energy areas close to smjor current systems, most of the energy is con-tained at wavelengths longer than 230 km. At wavelengths shorter than 230 km, the speatrum basically follows a k-3 (k is wavenumber) depen-dence. In the low-energy areas remote from asjor current systems, the speatrum follows a k-1 dependence at wavelengths from 100 to 1000 km. Heast on the assumption of horizontal isotropy of mescacle warlability, scalar-wavenumber spectra of sam-surface height and

Mineralogy, Petrology, and Crystal Chemistry

3770 Particles and seresois MARIME ARROSOL AT SOUTHERN MID-LATITUDES J.L. Gras and U.F. Ayora flivision of Cloud Physics, C.S.L.R.O., P.O. Box 134, Epping, N.S.W. 2121,

C.S.I.R.O., P.O. Box 134, Epping, N.S.W. 2121, Australial Results of an investigation of acrossol particles at Capa Grim (41°5., 145° L.) for the period February 1974 to May 1980 are presented. Size distributions were obtained for radit of ~0.003 to ~5 um. Those distributions typically are bimoded in dM/d log r vs log with modes at ~0.025 and 0.5 um radium. No evidence was observed for a nucleus mode previously reported for this site. The acrossol consisted of three distinct fractions, a small particle fraction of assumium sulfact, a see-sait fraction and a small fraction (~1%) of insoluble non-crystalline but otherwise unidentified particles. (Marine, acrossol.)
J. Geophys. Res., Green, Paper 300368

3770 Particles and Agrowals
OPTICAL PROPERTIES OF THE ASH FROM EL CHildhou
E.M. Patterson ischool of imphysical believes, imprite
Institute of Technology, Atlanta, thought, 19312) C.O.
Pollard and I. Callado
Wa have measured visible wavelength optical properties of the ash from the 1982 Et thicken armptions.
These measurements were unde on ash samples cullected

complex retractive mean in with the action of absorp-tion expressed as the mealinery component of the re-fractive index, nys. Each of those samples showed quite low values of absorption, with ny ut 500 nm

4230 Experimental mineralogy and patrology
FRASE CHARACTERIZATION OF SYMMETIC ANDMIROLS OF THE
JOIN Phy May Silon, 1001.

M.M. Befesch (Institut for Mineralogie, Pror-Universität
Bechau, 4630 Bechau, F.P. Gordanyi, M. Leuni
The crystal Localety of symmetic amphilologistic polutions with modified bully compositions becomes her
[51,0,1](001) and Mn. [89] [51](001) to them
[84,0,1](001) and Mn. [89] [51](001) to them
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[84,0,1](001) and Mn. [89] [51](001) to the form
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[84,0](001) and Mn. [85](001) an involinated. Synthesis rules extributed in the them involinated Synthesis rules extributed in the term of the term Ag. Hin., 68, 5-6

A. Hin., 68, 5-6

4270 Proporties of Minerals

HEAL CAPACITY, RELATIVE ENTHALPY, AND CALORIMETRIC ENTROPY OF SILICATE MINERALS: AN EMPIRICAL METHOD OF PREDICTION

G.R. Robinson, Jr. and J.L. Hans, Jr. (U.S. Geological Survey, National Center, Stop 969, Reston, VA 22032)

A procedure to estimate the standard woolar heat Capacity, relative enthalpy, and calorimetric entropy of silicate einerals has boun devised and evaluated. These are estimated by summing, in appropriate proportions, ficture molar isobaric heat capacities, relative enthalpy, and calorimetric entropy enthalpies, and entropies swaluated for structural components of the eineral phases such as Mg0-4, Mg0-6, or Mg0-8 where the Mg is in 4-, 6-, or R-fold coordination, respectively. The fictive molar heat capacities and entropies were obtained from a largo body of exporimental calorimetric data on heat capacity, entropy, and relative enthalpy for minerals. The summation technique has a pracision better than 2 parcont for heat capacity and relative enthalpy, and 5 percent for entropy, relative to the data base, between 204 and 150n X. The accuracy of prediction of molar hoat capacity and relative enthalpy for mineral phases and specific heat for rocks is expected to be within 3 percent using this technique. The accuracy of prediction of molar hoat calorimetric entropy is expected to be within 3 percent using this technique. The accuracy of prediction of molar hoat calorimetric entropy is expected to be within 13 percent using this technique. The accuracy of prediction of molar hoat calorimetric entropy is expected to be within 3 percent using this technique. The actuated heat capacity of an illite is calculated and compared with experimental data and compared with experimental data and on used in the evaluation. 3) The estimated calorimetric nolar entropy of an illite is calculated and compared with experimental data and on used in the evaluation. In each of these cases, the estimated values deviate lass than languals, heat capacity, entropy, relative e

4270 Properties of Minerals

AZIO Properties of Minerals A FELSPAR-LIQUID GEOTHERMONETE M. P. Smith (Department of Geoaclences, University of Tules, Tules, OK 74104)
A falspar-liquid geothermonater was empirically deciphered from the results of high temperature phase equilibric experiments. 797 experiments from 31 studies are considered. Plus or almos 15, 30, and 45 degrees are the 76, 97, and 100 per cent confidence leavis. All the experiments on terrestrial magnetic systems are matchingous, and are not completing normative. For this testricted range of composition the thermoster can be written as:

T(K) = 10⁵/(4.361-(7.747)ln(w)) " " (4-54s+64s²-44H³)(Al₂3-Al₂4)(b³-b⁴)

 $b = Al_{1}(1-P_{1}-2R_{1})/(1-2Ca_{1}+5P_{1}/2+3An/5-(En+Pa)/4-\pi/2)$

Risment consentrations are in cation wole fractions. The subscript x denotes the feldspar, I the liquid-Wole fraction CIPW moras in which the carlon sum of each component equals one,

G. Lagaly and K. Beneke (Institut für anorga-

generophik kinetic energy are also presented. Dynamical implications of these spectra are discussed. The effects of residual goold and atmospheric water vapor on the computed oceanic spectra have been rigorously exemined; it is found that the general characteristics of the oceanic spectra are not significantly affected by them. (Susset altimator, wave-mather. J. Geophys. Res., Group, Paper 30035

Particles and Fields-Interplanetary Space

Sign High-lecitude ionospheric currents (Particles and Fields-Lonesphere)

JOULE HEATING AT HIGH LATITUDES

J. C. Foster (Center for Atmospheric and Space Sciences, Useh State University, Lagan, Utah 84322), J.-P. St.-Hauvice, and V. J. Abreu

High latitude Joule heating has been calculated from stantianeous observations of the electric field magnitudes and the Federson conductivity reliculated from Individual massurements of the ion drift velocity and particle precipitation observed over the lifetime of the AB-C satellite. The data were souted by latitude, local time, healsphere, asseon, and K, index and separate averages of the electric field adjointed, Pederson conductivity and Joule heating were prepared. Conductivities produced by an averaged seasonal solar illuvination were included with those calculated from the High-latitude Joule heating occurs in a roughly oval pattern and consists of three distinct heating regions: the dayside cleft, the region of sunward convection at dawn and dusk, and the sidnight sector. On the average, beating in the cleft and dawn-dusk regions contributes the largost heat input. There is no apparent difference between heatispheres for statler seasons. Readsphere averaged Joule heating a function of Kp. The Joule heat input is 500 granter during the assess than Junia heat input is 500 granter during the assess than Junia heat input is 500 granter during the assess than Junia heat input is 500 granter during the assess than Junia heat input is 500 granter during the assess than Junia heat input is 500 granter during the assess than Junia heat input is 500 granter during the assess than Junia heat input is 500 granter during the assess than Junia heat input is 500 granter during the assess than Junia heat input is 500 granter during the same of the superior during the same of the same of the superior of the superior of the production. J. Goophys. Rom., Migu, Paper 3,0336

5380 Solar Wind Pissua
ON THE PREFERENTIAL ACCELEFATION AND HEATING OF SOLAR
WIND HEAVY IONE
Philip A. Isenburg and J.V. Rollwon (Space Science
Center, Physica Department, University of New Hampshire, Durham, RN 03824
We investigate the preferential heating and acceleration of solar wind heavy lone by the resonant cyclotron interaction with parallel-propagating left-polarland hydronagnatic towers. We set up a scenario
whereby the energy for this interaction to taken from
naturated low-frequency aliven were with a caseded to
the higher, resonant frequencies. In order to utilize
the existing theoretical work, the particles are taken
to be thermally isotropic and the waves are taken to
be dispersionless. This scenario is incorporated irro
an inner radius (taken to be 10 solar radii) to 1 AU.
Thus, we present the first model of a save-drivon,
three-fluid, supersonic solar wind. By varying the
model petameters, we test the ability of the reasonant
interaction in this model to produce the access speeds
and temperatures of heavy ions that are observed. We
find that unrealistically steep wave spectra are required to produce differential species on the order of
the Alfves speed at 0.1 AU. In the tase of Ne⁺⁺, the

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Volume 18, Number 4 Molodensky S. M., Zharkov V. N. The frequency-dependent Qu in the Earth's mantle and the Chandler webble Bronguleyev V. Vad., Grachev A. F., Kalashnikova I. V., Magnitsky V. A. On the relation of the recent and contemporary crustal movements with the basement depth of the East European platform

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Strakhov V. N., Lapina M. I. Calculation of gravity and magnetic fields for activities from problems of gravity data inversion involving coll-bearings and eplanetarys density structures.

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Weyl R. «Geology of Central America».— Reviewed by M. L. Somin 108

Atmospheric and Oceanic Physics Volume 18, Number 8

Garger E. K. Experimental Estimation of Some Similarity Theory Constants of Lagrangian Turbulent Characteristics in the Atmospheric Surface Layer Uralov A. M. Weak Shock Ways Damping in Isothermal Atmosphere Determined Using Correction for Dispersion .

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CHRONICLE

Ginsburg A. S. All-Union Symposium Physical Aspects of Climate Theorys. (Moscow, March 24 -- April 2, 1982)

111

110

All Property